

Listing of Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A plasma processing apparatus comprising:

a plasma processing chamber having a plasma excitation electrode for exciting a plasma;

a radio\_frequency generator for supplying a radio\_frequency voltage to the electrode;

a radio\_frequency feeder connected to the electrode; and

a matching circuit having an input terminal and an output end, wherein the input terminal is connected to the radio\_frequency generator and the output end is connected to an end of the radio\_frequency feeder so as to achieve impedance matching between the plasma processing chamber and the radio\_frequency generator,

wherein a frequency which is three times a first series resonant frequency  $f_0$  of the plasma processing chamber which is measured at the end of the radio\_frequency feeder is larger than a power frequency  $f_e$  of the radio\_frequency waves, and

wherein the first series resonant frequency  $f_0$  is determined from electrical radiofrequency factors of the plasma processing chamber and respective constituent elements disposed near the plasma processing chamber, the first series resonant frequency  $f_0$  correspondings to a minimum impedance of the plasma processing chamber, the minimum impedance evaluated with the plasma chamber disconnected from the plasma apparatus during a non-discharge period.

2. (Original) A plasma processing apparatus according to claim 1, wherein a frequency of 1.3 times the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$ .

3. (Original) A plasma processing apparatus according to claim 2, wherein the first series resonant frequency  $f_0$  is larger than three times the power frequency  $f_e$ .

4. (Currently amended) A plasma processing apparatus according to claim 3, wherein a series resonant frequency  $f_{0[1]}$ , which is defined by a capacitance between the plasma excitation electrode and a counter electrode for generating the plasma in cooperation with the plasma excitation electrode, is larger than three times the power frequency  $f_e$ .

5. (Original) A plasma processing apparatus according to claim 4, wherein the plasma excitation electrode and the counter electrode are of a parallel plate type, and the series resonant frequency  $f_0'$  and the power frequency  $f_e$  satisfy the relationship:

wherein  $d$  represents the distance between the plasma excitation electrode and

$$f_0' > \sqrt{\frac{d}{\delta}} f_e$$

the counter electrode, and  $\delta$  represents the sum of the distance between the plasma excitation electrode and the generated plasma and the distance between the counter electrode and the generated plasma.

6. (Currently amended) A plasma processing apparatus according to claim 1, further comprising a resonant frequency measuring terminal for measuring the resonant frequency of the plasma processing chamber, in the vicinity of the end of the radio\_frequency feeder.

7. (Currently amended) A plasma processing apparatus according to claim 6, further comprising a switch provided between the radio\_frequency feeder and the resonant frequency measuring terminal, wherein the switch electrically disconnects the end of the radio\_frequency feeder from the resonant frequency measuring terminal and connects the end of the radio\_frequency feeder to the output end of the matching circuit in a plasma excitation mode in which the plasma is excited, whereas the switch

electrically connects the end of the radio\_frequency feeder to the resonant frequency measuring terminal and disconnects the end of the radio\_frequency feeder from the resonant frequency measuring terminal in a measuring mode in which the resonant frequency of the plasma processing chamber is measured.

8. (Original) A plasma processing apparatus according to claim 6, further comprising a resonant frequency measuring unit which is detachably connected to the resonant frequency measuring terminal.

9. (Previously presented) A plasma processing apparatus according to claim 8, wherein the characteristics of the resonant frequency in the plasma excitation mode and the characteristics of the resonant frequency in the measuring mode are set to be equal to each other.

10-62 (Cancelled)

63. (Currently amended) A plasma processing apparatus comprising:

a plasma processing chamber having a plasma excitation electrode for exciting a plasma, a counter electrode, and a shower plate disposed between the plasma excitation electrode and the counter electrode;

a radio\_frequency generator for supplying a radio\_frequency voltage to the plasma excitation electrode;

a radio\_frequency feeder connected to the plasma excitation electrode;  
and

a matching circuit having an input terminal and an output end, wherein the input terminal is connected to the radio\_frequency generator and the output end is connected to an end of the radio\_frequency feeder so as to achieve impedance matching between the plasma processing chamber and the radio\_frequency generator,

wherein a frequency which is three times a first series resonant frequency  $f_0$  of the plasma processing chamber which is measured at the end of the

radio\_frequency feeder is larger than a power frequency  $f_e$  of the radio\_frequency waves, and

wherein the first series resonant frequency  $f_0$  is determined from electrical radiofrequency factors of the plasma processing chamber and respective constituent elements disposed near the plasma processing chamber, the first series resonant frequency  $f_0$  correspondsing to a minimum impedance of the plasma processing chamber, the minimum impedance evaluated with the plasma chamber disconnected from the plasma apparatus during a non-discharge period.

64. (New) The plasma processing apparatus according to claim 1, wherein the plasma excitation electrode comprises an overlapping area with respect to the chamber wall, the overlapping area adapted to set the first series resonant frequency  $f_0$  such that three times the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$  supplied from the radio frequency generator.

65. (New) The plasma processing apparatus according to claim 1, wherein the radio frequency feeder has a length adapted to set the first series resonant frequency  $f_0$  such that three times the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$  supplied from the radio frequency generator.

66. (New) A plasma processing apparatus comprising:

a plasma processing chamber having a first series resonant frequency  $f_0$  and a plasma excitation electrode for exciting a plasma;

a radio frequency generator for supplying a radio frequency voltage to the electrode;

a radio frequency feeder connected to the electrode; and

a matching circuit having an input terminal and an output end, wherein the input terminal is connected to the radio frequency generator and the output end is

connected to an end of the radio frequency feeder so as to achieve impedance matching between the plasma processing chamber and the radio frequency generator,

wherein the first series resonant frequency  $f_0$  corresponds to a minimum impedance of the plasma processing chamber, the minimum impedance evaluated with the plasma chamber disconnected from the plasma apparatus during a non-discharge period, and

wherein one or more structural factors of the plasma processing apparatus are adjusted such that three times the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$  supplied from the radio frequency generator.

67. (New) The plasma processing apparatus according to claim 66, wherein the one or more structural factors are adjusted such that 1.3 times the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$ .

68. (New) The plasma processing apparatus according to claim 67, wherein the one or more structural factors are adjusted such that the first series resonant frequency  $f_0$  is larger than a power frequency  $f_e$ .

69. (New) The plasma processing apparatus according to claim 66, wherein the one or more structural factors include an overlapping area of the plasma electrode with respect to the chamber wall.

70. (New) The plasma processing apparatus according to claim 66, wherein the one or more structural factors include a length of the radio frequency feeder.